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THE TECHNIC.

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FOR some time past the authorities of the Institute have been busily engaged in getting up copy for the new catalogue that is soon to be issued. While this is always quite a task it is even a greater one this year than usual, because there are several radical changes to be incorporated. The principal ones among these are the change from the three term to the semester division of the school year, and of the system of grading. The old style of numerical grading, and the requirement that every subject in the course be taken, will be displaced by a credit system, and while most of the subjects in a course will be prescribed, yet there will be several in the semester from which an election may be made. Among these will be such subjects as French, Advanced Algebra, Projective Geometry, Least Square, Quaternions, and subjects in other courses than the one pursued.

One hundred and forty-six credits will be required for graduation. Credits will be given for obtaining a passing grade, during the semester, in any one subject. The number of credits being proportional to the hours devoted to the subject and to the number of recitations given. A credit will, therefore, be the equivalent of eighteen recitations or fifty-four hours of practice per term.

The grades will be designated as "A", "B", "C", "D", and "E". The "D" grade will correspond to what is now known as a condition. A student receiving a "D" in any subject will not be entitled to a credit in that subject until he has passed an examination of sufficient merit to raise his grade. Preparation for this examination, however, may be made at any time and not necessarily in the class-room. It will readily be seen that though a student make but "D" grade in two subjects he will be permitted, under this arrangement, to carry on his other studies and not be compelled to lose an entire year, as has heretofore been the case. If, however, he makes but "E" grade in any subject, this must be made up in regular class exercises before he is entitled to a credit in that subject.

This system is in use in many of the schools throughout the country, and has been found to work much more satisfactorily than the old system. We believe the Institute is pursuing the right course in this matter, and think neither faculty or students will have any cause to regret the change.

THE first of a series of lectures upon general topics, that is to be delivered at the Institute this year, was given by Wm. C. Ball, President of the Board of Managers of the Institute and editor of the Terre Haute *Gazette*.

Mr. Ball's subject was "The Engineer as a Citizen," and touched upon several problems relating to employer and employee that the young engineer will be called upon to solve, at least in his own mind. He directed attention to the fact that perhaps in no other profession was good citizenship so essential, for all the divisions of government, from the city to the nation, are more or less dependent upon the engineer to plan and carry out their many public works. He struck the keynote of the engineer's wide influence when he said, "Any of you, that follow up your profession in a right manner, will not only benefit your immediate city, but all around."

We are glad to hear such lectures delivered before the student body, if for no other purpose than to remind them that they are in a larger world, one that will require of them more stringent duties than the immediate college world in which the average student seems to shut himself during his four years of college life. We have noticed how closely the conversation at the boarding clubs, and other places where the students are thrown together during their leisure hours, adheres to the school work and college episodes to the utter disregard of the questions that are moving nations and the things that are transpiring in this great old world of ours. Through our exchanges we learn that Rose is not alone in this tendency, but that the same is true at most all of the institutions of learning. This seems to us a very unnatural state of affairs, for is not the purpose of our institutions of learning to broaden, not narrow, the man?

We say we are glad to hear such talks as Mr. Ball's given before the students, because we have noted the discussions, and the awakening to the realization that there are other things besides our college pranks and mathematical deductions demanding our attention during our hours of relaxation from class-room work. In short, in regard to such lectures we would say, to use a common expression, "it's a good thing, push it along."

IN one of the old numbers of THE TECHNIC we ran across the following heading:

THE SENIOR TRIP.

The following is an accurate account of how the Seniors, under the direction of Dr. Mees, spent the time very profitably on the Senior excursion.

Beneath this very enticing heading is a blank column. Are we going to be forced to resort to some similar means of giving an account of the Senior trip this year? We hope not, we trust not, we believe not. For already a committee has been appointed, by the Senior class, to look into the matter and collect such data as should be presented to the Board of Managers, when the Senior trip is recommended to them by Dr. Mees.

Pittsburgh, Chicago, or St. Louis, are the principal destinations under consideration. The Alumni Associations of these cities could very materially assist the committee in getting up their data, by making inquiries and reporting to the committee the nature of the accommodations that can be arranged for the class in their respective cities.

Every member of the class of nineteen hundred and three is, of course, enthusiastically in favor of the trip. The faculty is lending their endorsement. The Board of Managers—well, with such an enterprising Board of Managers, we feel quite sure they will gladly grant, to the largest graduating class in the history of the Institute, that which makes the trip "a go."

WE have all noted every stage in the construction of the automobile that has been built in the shops, from the time the first casting was made until the lamps were put in place. Often have we wondered what could be the use of this or that particular piece. Through the courtesy of Mr. Paige, the builder, THE TECHNIC is enabled to present an article describing the carriage, which will doubtless enlighten us in regard to many of the intricate features.

THE TECHNIC desires to acknowledge its indebtedness to Mr. R. W. Hill, '04, for the photos illustrating the article.

The Construction of an Automobile.

By ARTHUR J. PAIGE.

A DESCRIPTION of the automobile recently completed at the shops of the Institute may perhaps be of interest to the readers of THE TECHNIC. This motor carriage was built entirely at the shops by the writer, according to original designs. The design was of necessity largely original, as at the time the vehicle was practically begun the manufacture of automobiles was in such an experimental stage, in made to build a power-driven vehicle complete in all its parts, built for constant and continual use, sufficiently powered for all ordinary purposes, and provided with gearing for speed changes and reverse, and all necessary fittings. A general idea of the carriage, as constructed, is given by the large cut on this page. As shown, the vehicle is provided with two seats, comforatbly seating four persons, the surrey type of carriage

this country at least, that very little literature on the subject could be obtained, while much that was obtained was almost worthless for the practical purpose of building a machine ; ideas and methods of construction varied with each builder. Few, perhaps, realize that it is only during the present season that gasoline automobiles have approached standard forms.

In constructing the carriage the attempt was being adopted with the necessary modifications in design for a power-driven vehicle.

The carriage belongs to the light-weight vehicle class, the total weight with tanks filled being about 850 pounds. It is propelled by a two cylinder, six b. h. p. gasoline engine, or more properly speaking, two complete single cylinder engines coupled together with cranks set at 180° for the purpose of balancing. This motor was designed during the summer of 1900, while the work of construction was begun in the fall of the same year at the Institute shops, the writer being at that time in the Junior class at the Institute. Some original features were introduced in the design, and as they proved to be practical, a detailed description of the motor will be given.

Fig. 1 shows a section of the engine through the crank shaft and cylinder axes, which will give an idea of the principal features of construction and the arrangement of parts.

The motor is of the four-cycle or Otto-cycle type, compressing to 70 pounds per square inch, designed to run at a normal speed of 1200 r. p. m., which speed, it may be well to add, is commonly exceeded under load. The two engines are constructed exactly alike with the exception that they are right and left, so that when connected together all similar connections, such as exhaust pipes, spark plugs, etc., are on the same side. These two engines are coupled together by a universal coupling to avoid any possible difficulty from shafts getting out of line. Two cylinders give a much more smoothly running motor than one cylinder, as the impulses are more frequent and the crank effort more nearly constant, while when properly set the reciprocating parts are very nearly balanced and vibration is considerably lessened, and then, too, there is a certain security in the feeling that if one cylinder fails the other will bring you in. On the other hand, three and four cylinders bring complications of parts and adjusting devices which rather offset the increased advantages in some respects.

The engines have a cylinder diameter of 3½ in. with a stroke of 4¼ in., and a very conservative rating is made of 3 b. h. p. per cylinder at 1200 r. p. m., giving 6 b. h. p. for the vehicle. (At the present writing no brake test has been made, but the results obtained while running the vehicle indicate that the full power is being obtained.) The motor is of the water-cooled type, water being carried in a tank and a radiator, both of which will be referred to again.

The special features of the motor are the cylinders constructed of steel tubing with cast iron water jacket, and one-piece crank shaft, together with enclosed fly-wheels, the latter being enclosed in the crank case, making a strong and compact

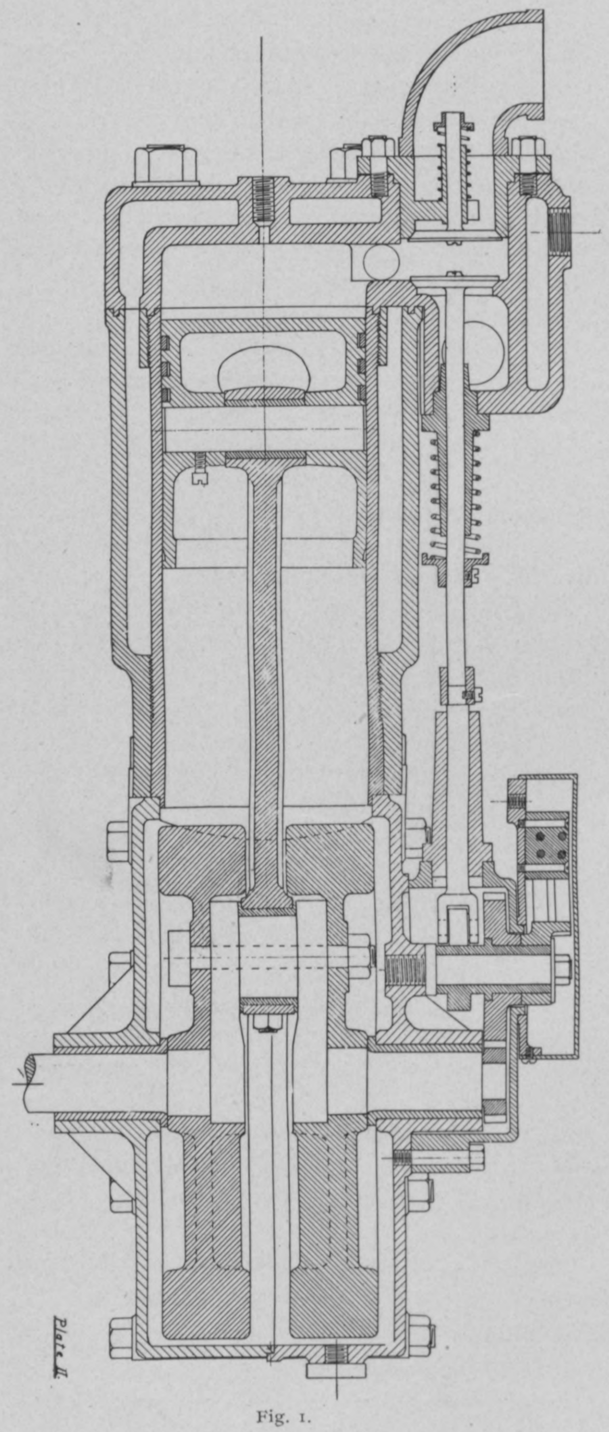


Fig. 1.

construction. Both of these features were introduced for the sake of durability and substantial construction, for the built-up crank or crank disk construction, commonly used in small gasoline engines usually refuses to remain built up, and cast iron cylinders for water-cooled engines are seldom free from flaws. The features of construction are shown in the sectional view of the engine. Each enclosed fly-wheel was recessed to receive the crank arm which was made especially thin and wide to take up as little space in direction of the shaft axis as possible, while the crank pin, although short, was made of large diameter to give proper bearing surface, so that the entire construction gives a strong yet very compact arrangement of crank and fly-wheels.

The cylinder was constructed as follows: An iron jacket with collar at each end, and lugs for attaching to crank case and head, was cast, and the collars were internally threaded, the thread at one end being continuous with that at the other; a seamless steel tube was then threaded at both ends for a short distance and turned down between the ends to allow the threads of jacket to pass at one end. The tube was then screwed into the jacket, the end to receive the cylinder head was grooved and a ground joint was made between cylinder and head, which, being without packing, has given no trouble whatever. The use of the steel tube gives a thin, easily cooled cylinder, which is free from flaws, strong enough to preclude any possibility of breakage by explosion and durable enough to last for years. In this case the cylinder wall between ends was made less than $\frac{3}{16}$ in. thick. This construction has proved perfectly successful, and was, so far as the writer knows, the first test of the construction (being made two years ago), though it may be of interest to state that a leading French firm has adopted practically the same construction this year.

The valves, made from drop forgings, were made large for high speed, the exhaust valve being operated by a cam which receives motion through the usual 2 to 1 gearing employed on four-cycle engines, while the inlet valve works automatically. The valves are surrounded by water jacket and are placed in the cylinder head as shown in diagram, a ground joint being used between the inlet valve cage and the cylinder head. This cage containing the valve can be removed by loosening two bolts, making the valves very accessible. The inlet pipes of the two cylinders are connected to a tee to which the carburetter or gasoline mixer is attached, one mixer being used for both cylinders. This carburetter is of the float feed or constant level type now universally used for automobile engines, and is provided with a throttle for controlling the engine which regulates the size of opening to the inlet pipe.

Jump spark ignition is used, the spark plug being placed in the cylinder head between the two valves. The switch, a very simple make and break device without a "trembler," is operated on the exhaust valve cam shaft. The source of current at the present time is a compound dry battery, a double Splitdorf coil provided with vibrators being used to transform the current, one coil being used for each cylinder. A small dynamo (a Motsinger "Autosparker") will furnish the current as soon as it can be installed. With this source of current, batteries are not necessary even for starting, and will be carried only for emergencies. A switch interrupting the primary circuit is provided at the carriage seat for stopping the engine.

Lubrication of the engine is by the splash system, all the oil used being carried in the crank case, where it is splashed into the cylinder and various bearings. The bearings are made of phosphor bronze, while aluminum is used for the engine crank cases and for casings and small parts throughout the vehicle.

The motor is controlled by throttling the supply of explosive mixture and by varying the time of sparking, and by these two means the speed and power of the engine can be varied between wide limits. The throttle and spark advancer are controlled by levers on the foot-board. By the spark alone the engine speed can be varied from 200 to over 1200 r. p. m. The variation in engine speed, together with the speed changes provided, allow the vehicle to be run at any speed up to the maximum.

Water for cooling the engine is carried in a tank having a capacity of about six gallons placed in front of, and above the engine. A radiator is also provided, consisting of 12 brass tubes each 24 in. in length and 5/8 in. diameter, provided with a large number of copper disks, or flanges, forced on the tubes. These disks present a large surface for air contact, and the radiator is placed in the front of and across the carriage, just under the foot board, so that the greatest possible air current will be secured over the radiator, and so the greatest cooling effect. The water flows from the top of the engine jacket to the tank, then to the radiator and then to the engines. At first, circulation by the thermo-siphon principle, or natural circulation was depended upon to cool the water. This method proved unsatisfactory, however, with the cooling system as arranged, and a centrifugal pump was provided to make the circulation more rapid and positive.

The gasoline tank is of five gallons capacity, sufficient for a run of about 100 miles on one filling, and is placed high enough to give gravity feed to the carburetter. The gasoline tank, spark coil and battery are placed under the front seat.

For deadening the noise of the engine exhaust a muffler is provided, consisting of an expansion chamber and a muffler proper. This device proves very effective, and the motor makes but little noise and runs regularly and smoothly with very little vibration.

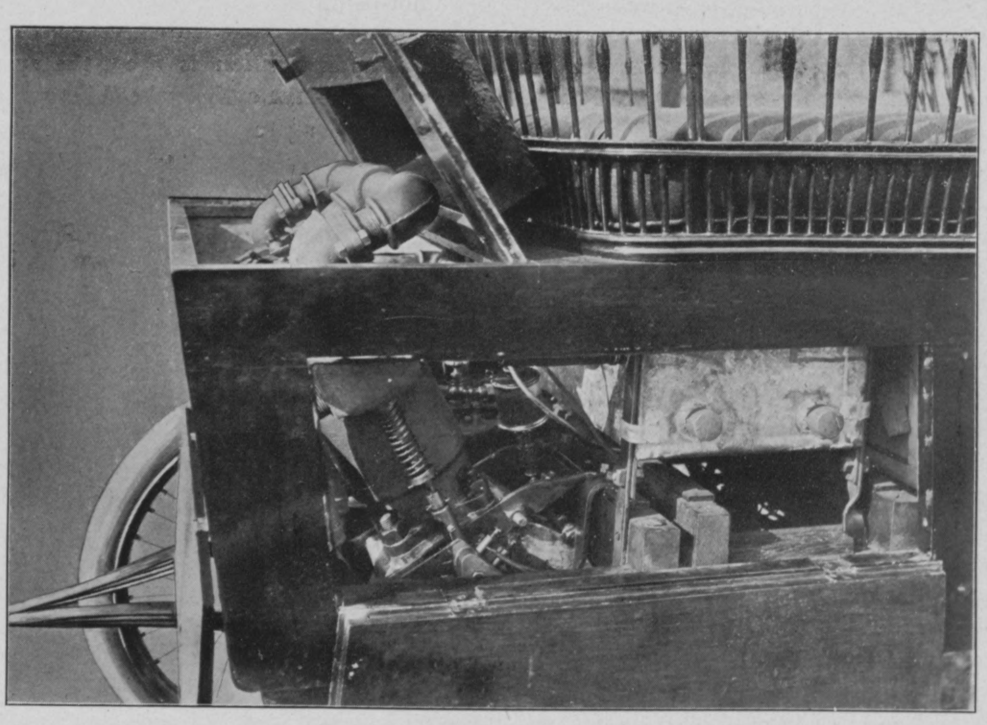


Fig. 2.

The engines are rigidly mounted in a nearly vertical position at the extreme rear of the carriage, on a secondary frame of steel bars (making the power plant a unit) which is attached to the principal frame of the carriage. The position of the motor and some accessories is well shown in Fig. 2. This principal frame or underframe, to which all parts of the vehicle, including the running gear, are attached, is the foundation of the carriage. This is a wooden frame made of ash strips 4 in. x 1⅝ in , and extends the full length of the vehicle, with crossbars for supporting the machinery.

On one-half of the engine coupling is placed a sprocket, and power from the motor is transmitted to the speed gearing by a Baldwin detachable roller chain 1¼ in. pitch and ½ in. width of roller, this size being also used to transmit the power to the rear axle. The gearing provides for two forward speeds of about eight and twenty-five miles per hour, and a reverse of about ten miles per hour at normal engine speed. This transmission gear is a very simple one, of original design, and of the sliding gear type, giving direct drive on the high speed with no idle gears in mesh. It is hung on the underframe directly in front of the motor. The writer regrets that an illustration of the gear could not be furnished, but a brief description will be given.

The principal shaft of the change gear is driven through a friction clutch by the chain from the engine. On one end of this shaft and projecting through one end bearing is a short sleeve, to the outer end of which is attached a sprocket from which a chain is carried to the differential on the rear axle. On the end of the sleeve projecting into the gear box is mounted one-half of a claw clutch, while next to the clutch a spur gear is keyed which meshes with a gear keyed on a second shaft in the gear box. On this second shaft two other gears are keyed at equal intervals with space between gears. On a third short shaft an intermediate gear is mounted to give the reverse motion. On the first shaft a sliding pinion with key is moved along that portion of the shaft not occupied by the sleeve, so as to successively engage with the gear on the third shaft, and with one gear on the second shaft giving the reverse and the slow forward speeds.

On one face of the sliding pinion is cut the other half of the jaw coupling, so that when moved out of mesh with either of the two gears and to one extreme position the claw coupling between pinion and sleeve engages so that the sleeve and shaft are connected. This means that the sprocket on the sleeve is clutched to the first shaft (driven by the engine) and so the drive is made direct on the high speed (through the friction clutch, of course) with the pinion out of mesh with the other gears. The gears run in an oil bath in the enclosed gear box. The friction clutch used is a simple leather-faced cone clutch held normally in engagement by a coiled spring, and released by the lever shown in the illustration of the carriage at the side of the front seat. At the present writing the carriage is being run on the direct drive, the slow speed and reverse gears not being fitted, but these will be installed within a short time.

The running gear is of the reachless type. The wheel base is 66 in., while the tread is standard 4 ft. 8 in. The wire wheels used were made especially for the vehicle according to specifications furnished by the designer, being unusually heavy in all parts, and are fitted with 3 in. Goodyear single tube pneumatic tires.

The rear axle is solid from end to end, the action of the compensating gear or differential being obtained by providing a sleeve, to which one wheel is bolted, over the axle on one side of the differential. Roller bearings are used, to the casings of which the springs and radius rods are attached, making a very simple and neat gear. To the differential (Brown-Lipe spur gear type) is fitted a double acting band brake, controlled by foot lever on the foot-board of the carriage. The front axle is a solid steel bar fitted with the usual knuckles for steering, while the front wheels are ball-bearing.

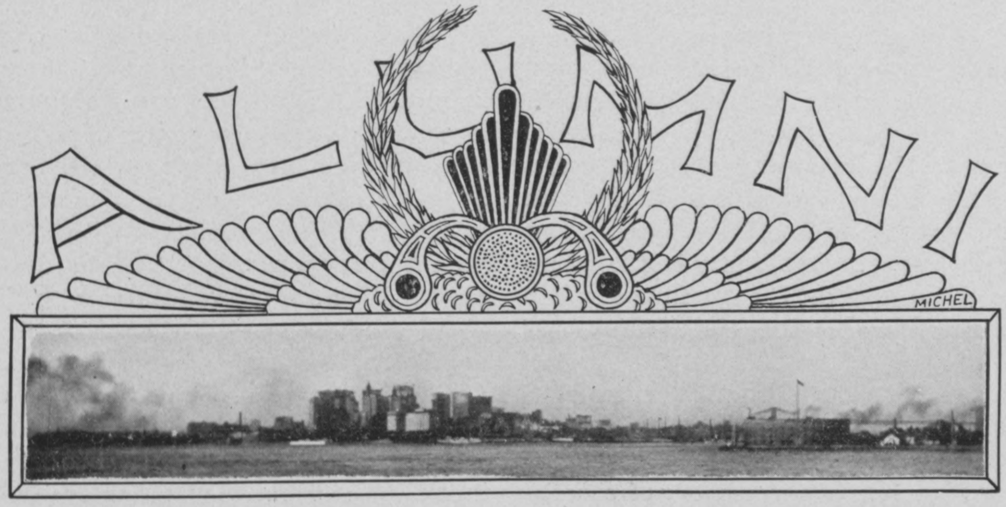
Steering is accomplished by a lever of the side-steering type, but the column is placed in the center of the carriage, so that the vehicle can be guided from either side of the front seat by throwing the lever over. Very long full elliptic springs are used for the rear, platform springs being used in front, giving a very easy riding gear.

The body, though following somewhat the lines of the usual steam surrey, was especially designed and was constructed quite differently from the usual type. As an example of the rapidity with which the automobile industry has advanced and ideas have changed, it may be interesting to note that at the time this body was designed and built (less than two years ago) the tonneau, now so popular and so universally used for four-passenger vehicles of all powers, was almost unknown in this country, in fact, at that time was severely criticised, and its future popularity was questioned.

The body of the vehicle constructed consists merely of a strong frame-work supporting panels on every side and resting on the underframe of the carriage. Fig. 2 shows how accessible everything is in the rear of the carriage, and almost every part is equally accessible, there being nothing but frame-work and panels everywhere.

The carriage was built entirely by the writer in the Institute shops; motor, transmission gear, running gear, body and nearly all accessories and small parts, about three months actual working time being required, (exclusive of design), but as only spare time, thesis time and some vacation time was used, the period of construction extended over two years.

In the beginning the writer made the patterns for castings, but by far the greater part of this work was done under the direction of Mr. E. T. Wires, of the wood shop, according to the designer's plans, and the writer wishes to acknowledge at this time the indebtedness to him for his great assistance. The list of those, however, to whom the writer is indebted, in many ways, would include all who have been connected with the shops during the time of building the vehicle, and many students of the Institute, but especial thanks are due to Mr. Clement, superintendent, and Mr. Logan, foreman of the shops.



Electricity in the Navy.

By HARRY B. STILZ, '98.

SINCE the days of Erricson when he set before the world the famous little monitor, which so revolutionized naval architecture, the design of a man-of-war has undergone a continual evolution. The improvements, since then, have been matters of detail, and not of principle, for the methods of offense, defense and propulsion were fundamentally the same then in the first monitor, as now, on a modern battleship. As a matter of detail, however, this same monitor was something horrible, and towards the improvement of this, the combined efforts of practically the whole engineering world have been exerted.

Electricity, of course, found ready application toward accomplishing this end, and the various uses of this force, in thrusting old forces aside, as well as solving new problems in ever increasing proportion. It is in fact only keeping pace with advances in that line everywhere, for a battleship can well be considered a floating city, complete within itself, so well provided is it with all modern improvements.

For lighting purposes electricity is used almost exclusively. In connection with search-lights it is almost indispensable, for a battleship would be helpless to various forms of attack without this on a dark night.

For interior communication, electricity is used extensively, in connection with voice tubes, as well as through the regular telephone system.

The powder and range indicators, the rudder indicator, the revolution indicators for the main engines, the general alarm systems, the automatic fire alarm thermostats, and many other indications, are transmitted with its aid.

Night signaling is generally done through the agency of electric lights on the masts, although this seems about to be supplanted, at least in part, by the Marconi system of wireless telegraphy, which is being installed on all large ships now building for the U. S. navy.

For supplying power to the various auxiliaries distributed throughout the ship, electricity is gradually supplanting steam, and it would seem to be only a question of time until it was used in all auxiliaries.

In this respect the Russian government is considerably ahead of the United States, at least on two of her vessels, which were built at Cramp's, in Philadelphia, during the last few years. On these boats (a battleship and a protected cruiser) practically all the auxiliaries are driven by electricity, although some in connection with steam also. For example, the steering gear can be operated by means of a steam engine, an electric motor, or by two separate and distinct hand gears. Perhaps this was carrying the matter too far from a practical point of view, in adding a large amount of unnecessary weight, but it may be helpful toward bringing about the change from steam to electric stearing gear entirely, in the course of time.

It must be admitted, however, that, as installed on board these Russian ships, a fair decision would have to be rendered in favor of the steam stearing engine, not only as a matter of simplicity of operation, of weight of machinery in use, of deck space occupied by machinery, but also from the standpoint of efficiency. First cost is a thing rarely ever considered in naval work. The best must be had regardless of cost. This gear would appear to have been installed more as an experiment than otherwise, and the system will have to be changed considerably before it can take the place of the steam engine. A brief description with diagram will be offered, to give an idea of the principles involved.

"R" represents the steering wheel located at the steering station, and consists of a form of Wheatstone bridge, through which is continually passing a current of about two amperes. The contacts "a" and "b" are connected to the fields of a small generator, which is kept continually running by a motor attached to the same shaft. By turning the arm "a-b" in either one direction or the other, the generator "d" will supply a current correspondingly. The brushes of dynamo "d" are connected directly to the fields of a large dynamo "D" which is kept running continually by means of a steam engine.

The dynamo "D" can, of course, be used for no other purpose, when steering by electricity, although it can be thrown on the bus bars at other times. The excitation of the fields of generator "D" by generator "d" causes current to flow in either direction, at the will of the operator at "R", through the brushes of the motor "M", which are directly connected to the brushes of "D". The fields of the motor are constantly excited.

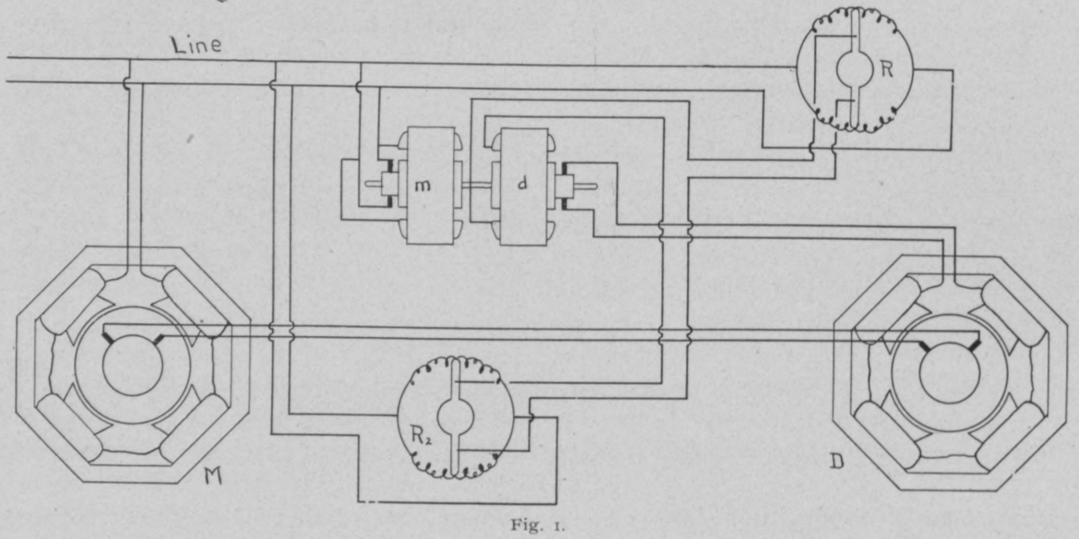


Fig. 1.

Motor "M" operates the stearing gear directly.

Attached to the rudder-head is another resistance "R_2", similar to the one at the steering station, the two being so connected that when the steering gear is started in one direction by the lever, "a-b", it will continue to move until the rudder has turned through the angle as indicated by "a-b", when the system will be in equilibrium and no current will flow through the generator fields, and the motor will stop.

The principle, although a pretty one and a safe one, is scarcely practical from the standpoint of economy.

It would seem that a more efficient means might suggest itself by supplying and controlling the steering gear motor direct from the line.

The steering gear is one of those auxiliaries which requires a large amount of power for short intervals only, and the source of power that can be used to best advantage should be accumulative. The hydraulic gear offers the easiest solution of this problem, and indeed, while not used nearly so extensively as the steam gear, it is found very successful on some of the boats in the U. S. navy.

An electric accumulator of light weight might enhance the value of such an auxiliary, although the generators installed are able to stand an overload of over 33½% for sufficient length of time to stand any such shocks.

In considering the application of electric power to ships in the U. S. navy, particular attention will be given to the sister ships Kearsage and Kentucky, which are most thoroughly equiped in the electric line. On these boats the only auxiliaries using steam are the ash hoist engines, the pumps, compressed air refrigerating engines, torpedo air compressor, forced draft blowers in boiler rooms, one winch, the windlass and the steering gear.

The dynamo room is located amidships between the forward and after boiler rooms, and is two decks high, each having 11 ft. head room. Three 50 kilo-watt generators, two large ventilating fans and the main switchboard are located on the upper level. The lower level is divided into two compartments, in each of which are two 50 kilo-watt generators. Ventilation is effected by means of supplying air with blowers, the exhaust escaping through two large trunks extending through the deck over the upper dynamo room to the upper deck of the ship. The rate of supply is such as to completely change the air in the rooms once every ¾ minute. The generators are driven by direct connected tandem compound engines, running at 310 revolutions per minute with 110 lbs. steam pressure. This pressure is kept fairly constant by Foster reducing valves.

These two are the only boats in the navy fitted with the three-wire system, the voltages obtainable being 80 or 160. The advantages gained by this system are questionable, when all the necessary complications are considered.

Recently the standard voltage to be used has been raised to 125 volts. The steam pressure on the engines has also been raised to 150 lbs. since the advent of the water-tube boiler into the navy.

One disadvantage of having a high voltage arises from the fact that the searchlights require a fixed voltage for the best results. Therefore there must be supplied with each searchlight a rheostat to have a dead resistance, which, when heated, will give a drop of from 55 to 65 volts. Large searchlights require higher voltage than smaller ones.

The variable resistance in the rheostat is adjusted to give a voltage at the searchlight of from four volts below the best working voltage, to six volts above this. This disadvantage is more than offset, however, by the increased efficiency of transmission elsewhere.

From the switchboard are led three distinct systems of wiring, one for searchlights, one for power, and one for lighting. The lighting circuits are divided into two sections, the battle lights and ordinary lights for illumination. The battle lights are those which cannot in general be seen from the outside. They include all lights below the protective deck and such above as are necessary for operation of the ship in action. All battle lights above the protective deck, which might be seen from the outside, are controlled by individual switches, and may be extinguished or covered.

The lights for illumination under ordinary conditions have separate mains which can be put out at the switchboard.

The power circuits are distributed throughout the ship in the ordinary way with one exception, viz: that supplying the turret-turning motors.

The problem of finding some reliable means of turning this most important part of a battleship, the turret carrying the heavy guns, is by no means an easy one. Steam, compressed air, hydraulic and electric power have all been used.

Steam is open to the objections of radiating heat into the magazines, danger from scalding, and trouble from condensing in the engines.

Compressed air is free from these objections, but is not so positive and reliable in its action as hydraulic power, which affords a simple, light and smoothly running type of engine. Hydraulic power is extensively used by various foreign navies, and was until recently used in our own navy. Electricity is, however, being used exclusively in the U. S. navy at present, and the hydraulic gears are being replaced by it in many old ships.

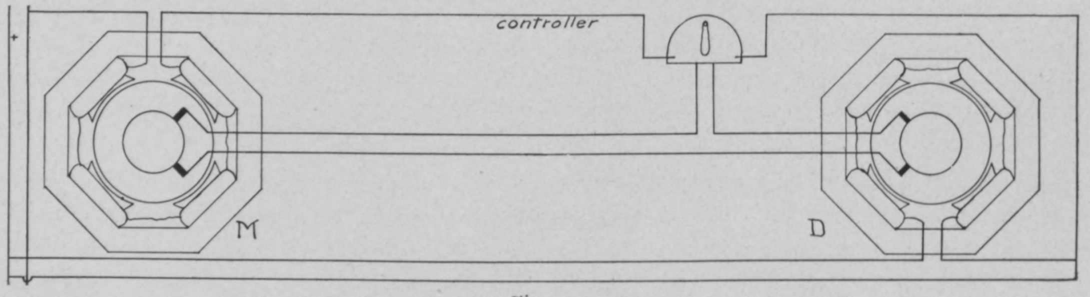


Fig. 2.

The method of speed control for the turning motors, as adopted on the Kearsage and Kentucky depends upon the fact that the speed of a motor armature running in a constant magnetic field is proportional to the volts impressed upon its brushes. There are two 50 h. p. motors in each turret, and one independent generator is needed for each turret for supplying the current. The switchboard is so arranged that any dynamo can be thrown on either turret. The fields of the motors and generators are separately excited from the switchboard bus-bars. The series coil in the generator field is short circuited and the terminals of the shunt field are connected to the busbars through a controller located in the turret. This permits the operator in the turret to control the voltage of the generator and therefore the speed of the motors in the turrets, the armatures of which are connected in multiple, directly to the dynamo brushes. The controller, in addition to operating the generator field rheostat, also sends the current to the motor armatures in the direction to give the rotation required.

"D" is the dynamo driven at constant speed by an engine. "M" is a motor in the turret, its fields being supplied at constant voltage, and its armature being connected mechanically to the other armature in the turret and to the turning gear by means of worm and bevel gearing, a friction clutch being provided at the pinion, which moves around with the turret meshing with the fixed gear in the barbett, the purpose of the clutch being to save the gearing from any shock.

The controller for "R" is directly under the sighting hood and controls the field of the dynamo "D". Should either motor fail it can be cut out, either electrically or mechanically, from the other motor. Should both motors fail, a slow hand gear has to be resorted to. Electric motors are also provided in the turret for hoisting amunition, elevating guns, and ramming charges. These are operated by the ordinary rheostatic controllers, and are on ordinary power circuits. They are shunt wound, as are in fact all the other motors, except those for running the winches, which are series wound.

In all motors shunt wound, the fields are excited at 80 volts, although the armature can be used at either 80 or 160 volts.

The ventilating motors are direct connected to their respective fans, the speed variation being effected by varying the field current in the motor.

The motors operating the boat hoisting gear, on the large boat cranes, are connected to the winding drums through worm gearing, and are provided with a controller somewhat out of the ordinary, they being designed to give electric braking in lowering a boat, on the principal that a current generated in the motor armature will use up external energy. The connections are the same as for the rheostatic controllers for hoisting, but on acting as a brake controller for lowering, a different combination is made, so that the rheostat to which the motor is connected, instead of being in series with the armature, and gradually short circuited, as the armature is brought up to speed, is connected across the line in shunt with the armature.

up, should the current be cut off. This brake requires a continual flow of electricity through the solenoid, which, of course, reduces the efficiency to a certain extent, but not so much as would worm gearing if it were used in its stead. As it takes more power to lift the cores and loosen the band than it does to hold them up, some saving is effected by having the controlling panel so arranged that the starting rheostat is thrown into the solenoid circuit as the motor is brought up to speed.

The motors in all cases are placed at the loading platform at the bottom of the trunk. For powder-hoists this brings the motor in the magazine. The controlling panel for the motor is placed close at hand, also in the magazine. At

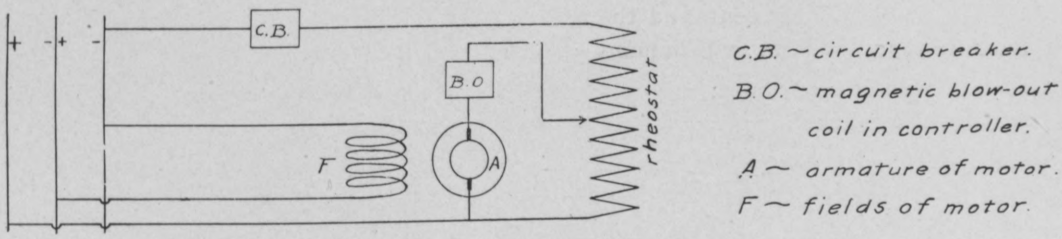


Fig. 3.

By this method a small amount of current is taken from the line through the rheostat during the time the armature is being operated, beside the current taken in or given out by the armature itself.

The ammunition hoists for rapid fire guns, used in the U. S. navy, are of the endless chain type, fitted with toes at regular intervals, which catch the charge at the loading platform, carrying it up to the gun deck, on one side of a partition in a box-shaped trunk, the chain running back on the other side. These hoists are all run by electric motors through spur gearing, and are provided with friction clutches, so that should the chain become blocked in any way, the motor may continue running without damage to the gear. An automatic solenoid brake is also provided, which is made to tighten a friction band around a wheel on the motor shaft the instant the voltage fails. This prevents the hoist running back on itself from the weight of ammunition in process of going

first sight, this would appear to be objectionable, in that a spark from the motor or switches might be the cause of an explosion. No danger is to be feared from this source, however, as the powder is kept in water-tight copper tanks, the cover of which is not removed until the charge is about to enter the gun. Although the magazine is practically free from danger of sparks, every precaution is taken to keep the temperature as low as possible. This is especially so, since the smokeless powder has been in use, as it is found to deteriorate at not very high temperatures. All electric wires are kept out of the magazine if possible, even though such wires are protected by iron conduits everywhere throughout the ship. Magazine lights consist of incandescent lamps, fitted in a lantern, which is placed in a box, well ventilated and opened from some adjacent compartment. It may be that these boxes are merely remnants of the old magazine lights, where lamps were used, and where good ventillation was necessary. An incandescent lamp gives forth so little heat, and is only lighted when the magazine is in use, and therefore well ventilated, that it would seem that a more simple fixture could be installed to better advantage.

Some trouble has been experienced with the controlling panel for the hoist motor as supplied on some of the recent ships. These panels have a discharge resistance for the shunt fields, so connected to the main line switch that if the blades of the switch are in contact with the clips, but are not completely pushed in as far as they will go, the discharge resistances will be directly connected across the line. On several panels on the U. S. S. Illinois the blades were left in slight contact, with the result that the discharge resistances were completely burned out, causing serious damage to the panel and connecting feeders, and filling the magazines with smoke. Although in the future the panels will still be placed in the magazines, their design will be changed so that no possible manipulation of the switches will allow the discharge resistances to continuously receive the full line voltage, or else the discharge from the fields will be through the motor armature, the field circuit remaining closed, until after the motor had been disconnected from the line

In connection with the electric winches it need only be said that they are of the ordinary street car type, as is also the controller for same. Until recently the speed variation, for wide limits, was effected by means of back gearing. In the latest winches the gearing consists of a small pinion on motor shaft with a large gear on drumhead shaft, the high speeds being obtained by throwing a shunt across the motor fields, with controller on last notch.

Whether the use of electricity offers sufficient advantages to support its application as a source of power for all auxiliaries on board ship is a question open to debate. There are many things in its favor. In the first place, the steam engine auxiliary as now used on ship is not an efficient one, nor can it be such from the nature of the work it has to perform. The principle of reversing, which is found necessary for simplicity and compactness, consists in interchanging the supply and exhaust ducts to the engine slide valve, by means of an ordinary piston valve, which is shifted to one end for running in one direction, or to the other end for the other direction, with the ports closed, when the piston valve is at the the center. This method requires that the slide valve of the engine be without lap or lead, so that there can be but little or no expansion in the engine cylinders.

When we compare this type of engine with the high-speed compound engine, direct connected to its dynamo, the combined efficiency of the two varying from 70% at half load to 86% at full load, supplying electricity to a motor with an efficiency of about 80%, it would seem that the advantage is with the electric auxiliary. All the more so, when we consider that an auxiliary is often in use only for a few minutes at a time, as in raising a boat or the like, since the steam used in heating the piping and engine itself must detract considerably from its efficiency.

The loss of energy from radiation of heat, from the steam pipe leading to the auxiliary, is not only wasteful, but also a source of considerable annoyance when running through the living spaces. The annoyance is most marked in warm climates, of course, for no matter how well protected the pipes may be, radiation will be felt, and especially where the pipe penetrates a bulkhead, the pipe being in direct metallic contact at that point, a large surface of radiation is thus afforded.

In time of action the steam piping running to the various auxiliaries is subject to the danger of being struck by a shell and considerable trouble caused by the escaping steam.

On the other hand, the dynamos located below the protective deck in a compartment near the boiler rooms with all the steam pipes to the engine well protected, form an ideal source of power from which are led the various feeders carrying the electric current to various parts of the ship, any one of which can be shot away without affecting anything but the machine connected to it.

ALUMNI NOTES.

J. C. Larson, 1900, has just begun the installation of a new power station for the Milwaukee Electric Railway, at Milwaukee, Wis.

Edward Walser, '96, is now a cyanide expert for the Gold and Silver Extraction Company of America, at Denver, Colo. His address is 1716 Blake street.

Cale Walmsley, '98, has a position with the Texas & Oklahoma Railroad Co., as Resident Engineer on Construction, at Shawnee, O. T.

Jesse I. Brewer, 1900, has resigned his position with the Penn. R. R., and has accepted one in the shops of the N. Y. C. & H. R. Ry., at Albany, N. Y.

Chenoweth Housum, '02, who has been with the Youngstown Engineering Co. since graduation, has accepted a position with the Wm. Todd Engine Co., at Youngstown. Ohio.

Walter L. Decker, '96, recently with Westinghouse, Church, Kerr & Co., is in the mechanical department of the George A. Fuller Co., of New York City.

Richard Merriwether, '96, who has been with the Western Electric Co., at Chicago, has taken a position with the Louisville City Railway as Assistant Superintendent of Power.

W. G. Davis, '99, who has been with the General Electric Company, is now with the Messrs. Dodge & Ray, Consulting Engineers, of Nicetown, Philadelphia, Pa.

Charles H. Jumper, '02, of the Penn. R. R. Co., at Altoona, Pa., made his friends and relatives a short visit the last of February.

Fred H. Froehlich, '99, has accepted a position as Electrical Engineer with the Toledo & Western R. R. His headquarters are at Sylvania, Ohio.

Waldo B. Ryder, '98, has the title of Treasurer of the Ryder Wagon Company, at Charlotte, N. C. The company has been organized, and they expect to begin operations very soon.

Taylor W. Ross, '93, is now with the Newport News Shipbuilding and Dry-dock Co., at Newport News, Va.

Oscar Rauchfuss, '88, has left Milwaukee and has taken a position with the Gulf Refining Co., at Port Arthur, Tex.

Rumor has it that George E. Wells, '96, is to be married on March 14, to a St. Louis girl. Wells is of the firm of Ruebel-Schwendtmann-Wells, Consulting Engineers.

Cards have been received by friends in this city from Berea, Ky., from Mr. and Mrs. Samuel G. Hanson, announcing the marriage of their daughter, Mary, to Mr. Horace Brenamen Jones, on Monday, February 9th. Mr. Jones is a nephew of the late Horace B. Jones and is himself a graduate of the Rose Polytechnic Institute of about ten years ago. Many friends in the city will remember him and extend their congratulations.—[*Gazette*.

The Pressed Steel Car.

By RICHARD A. OGLESBY, '04.

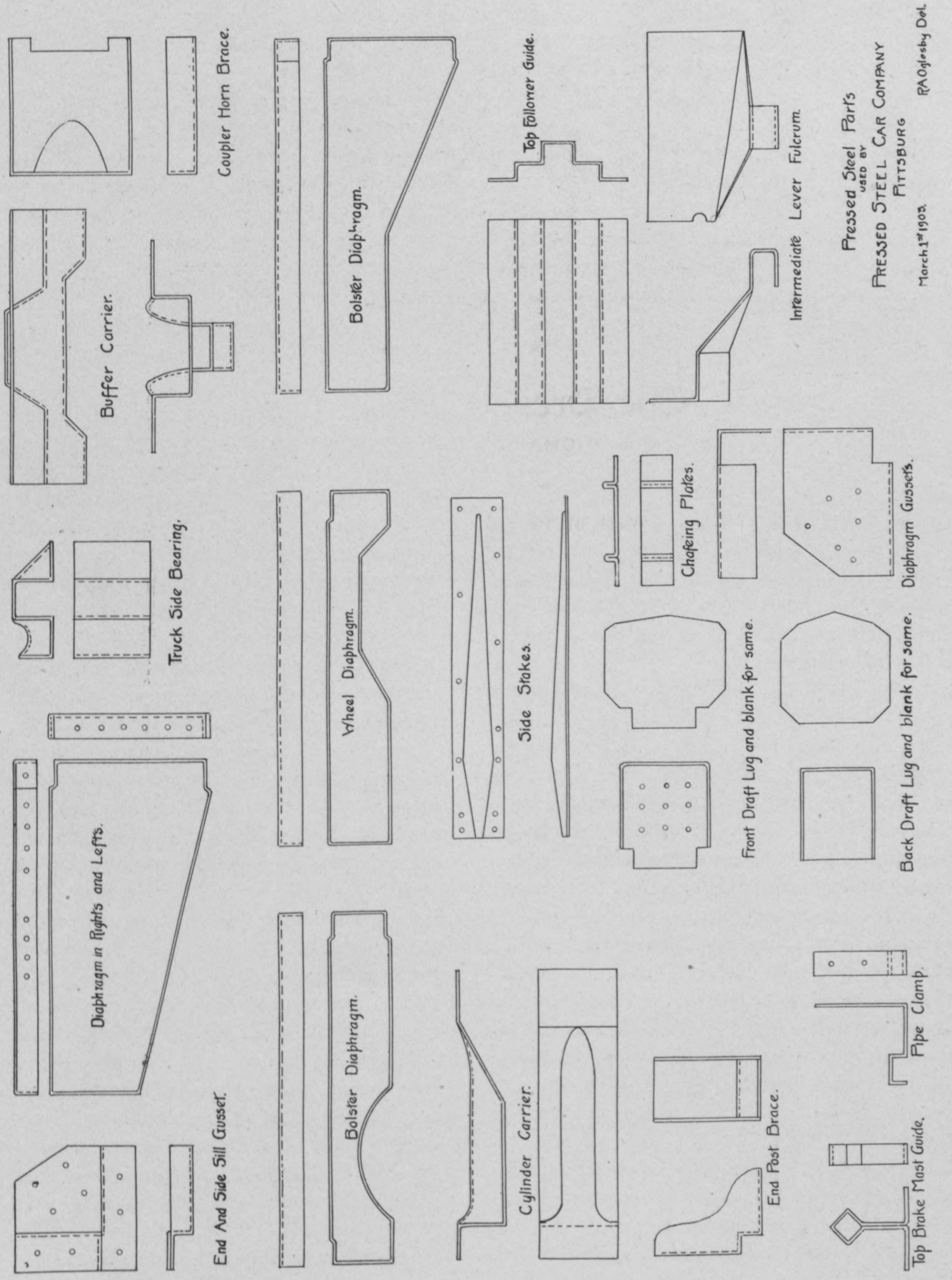
OWING to the enormous growth of freight traffic, especially along the lines of coal and ores, in recent years, the builders of freight cars have been taxed to the utmost to keep pace with the demand and fill the ever-increasing orders for more cars.

The scarcity of properly cut and seasoned wood, the dead weight and dead room of the same has caused engineers to turn toward steel as the coming material for the construction of freight cars. Some go even beyond a mere freight car, and seriously consider the building of passenger coaches from steel. The resistance of the steel car to wear and tear, shocks and kindred accidents of the life it leads, has caused steel cars in many ways to force the wooden ones to the wall.

There is only one objection to the steel car. Unfortunately, wrecks will occur, and while the steel car will not break, like a wooden one, it will bend and tie itself into knots that would puzzle a sailor. Of course, a buckle in a sheet is a simple matter to repair, but let a pressed piece be bent and it is done for. They can even be reheated and passed through the same dies that made them, but to no avail.

I had the pleasure of working at both the Schoen and McKee's Rock plants of the Pressed Steel Car Co., and shall try to describe their shops and methods of work. The Schoen plant employs perhaps 2,000 men in the different departments, and has a daily capacity of 50 steel cars. The McKee's Rock plant employs about 5,000 men, and has a daily capacity of 150 cars, some wooden and some steel. Steel under-frames and trucks are also made and sold to other firms and to the railroads direct.

The principal pressed pieces on a car made by the Pressed Steel Car Co. are named in the following order; Center sills, which run the entire length of the car, carry the draft rigging, and with the side sills, which also run the entire length, support the load. Diaphragms, which, with gussets and angle plates, connect the sides and center sills. Bolsters and inside stiffeners, which still further knit the structure together. Diagonal struts that brace the upper part of the car. Side stakes, to connect the side sheets and resist vertical shear. Draft lugs and follower plates, which resist the jolts from the switching; and a great number of smaller pieces, center plates, top follower guides, buffer supports, reservoir carriers, stirrup supports, bulb angles, dead and live lever fulcrums, pipe clamps, etc., etc., all going to make the structure a complete one, if not a thing of beauty and a joy forever. Some of these pieces are shown in the sketch.


Coupler Horn Brace.
Buffer Carrier.
Bolster Diaphragm.
Top Follower Guide.
Intermediate Lever Fulcrum.
Pressed Steel Parts
USED BY
PRESSED STEEL CAR COMPANY
PITTSBURG
March 1st 1903.
R.A. Oglesby Del.
Truck Side Bearing.
Wheel Diaphragm.
Side Stakes.
Chafeing Plates.
Diaphragm Gussets.
Front Draft Lug and blank for same.
Back Draft Lug and blank for same.
Diaphragm in Rights and Lefts.
End And Side Sill Gusset.
Bolster Diaphragm.
Cylinder Carrier.
End Post Brace.
Pipe Clamp.
Top Brake Mast Guide.

To my mind, the manufacture of steel cars may safely be said to be in its infancy, and offers to the mechanical and civil engineer a very wide opportunity for investigation, as will later on be seen. The sheet steel is bought for the Pressed Steel Car Co. from Carnegie's Homestead works, and comes in car load lots of all widths and lengths. This steel is not inspected as to its grade and quality when sold, and sometimes does very curious things under the shears, or when troubled with the combined influence of heat and pressing. The loaded cars are backed into the shearing department and unloaded by "hunkies." Conservatively speaking, "hunkies" are men and—but that's another story. Busy men with wooden templates, which are sized and shaped according to experience, mark the sheet steel into the desired shapes, and other men, still busier, feed the marked steel to the shears, whose steel jaws follow the various lines of soapstone and turn out the blanks from which the finished product is to be made. More "hunkies" pile the smaller pieces on trucks and remove them to other departments, or large 10 and 15 ton travelers swoop down, pick up bundles of long snaky sheets and hustle them to another end of the aisle; here a swing back and forward, and then the whole pile of clanging metal is bodily thrown into another department, where still another traveler makes way with it. The smaller pieces, or "blanks," as they are called, are trundled on into the pressing department. Here are twenty presses whose pressures vary from the baby of 1,500 pounds, which handles the small pieces of $\frac{3}{16}$ steel, to the monster of 750 tons, that forms the large center and side sills as easily as the small boy creases paper in the kindergarten. Some of the pieces are pressed cold, but the majority have to be heated. The furnaces line the walls of the aisle, and are in pairs, one pair to each press.

To a person accustomed to labor-saving machinery that operates to a certain degree of precision, the press seems extremely crude. The bed plates become broken and out of line. Odd scraps of steel are used to shim up the dies, cumbrous blocks and bolts hold them in place, lost motion and a wealth of play reign supreme. The dies, made of cast-iron, and lined with bearing plates of the same material, become worn and channeled. No two pieces are ever turned out alike. Blanks may be cut to $\frac{1}{16}$ inch of the same size, heated to the same temperature, put through the same press, and yet show differences of one inch or under in various dimensions. Here too, the bad steel comes into evidence.

Sometimes cinders will get into the steel as it is being rolled, with the resultant blister on the pressed piece, or in the worse cases the edges will show like the leaves of a book. Sometimes, even in a small blank, two different grades of hardness will be encountered, with the result that the softer end will pull thin. Yet such is the haste for the finished material that nothing is done. New bearing plates, new dies, new bolts, more scrap for shims, but no new and better machines. A steam engine called a "Bulldozer" is used to supplement the hydraulic presses, but this has the same trouble with the dies.

The worst cases of spoiled pieces are thrown into the scrap pile, to be resold to Carnegie with the refuse from the shears and other departments, some are put together into the cars used by the company, and not a few are mingled with the good and put on the cars with the hope that they will evade the argus-eyed inspector. The company has its own corps of inspectors, whose duty it is to see that the "passed" work is up to some standard, and the different railroads have their own inspectors who also pass judgment on the work. The railroad inspector is a hard man to please when the work is bad, but sometimes they are pleased—a box of cigars now and then.

The pressed pieces are now taken to the different assembling departments, the truck yard, the bolster dock, or distributed among the erection aisles. One aisle will be assembling the underframes, another the side sheets, still others the car complete.

Gangs of men hurry here and there riveting parts together by hand, by small pneumatic riveters, or by the larger Bull riveters. The heavier pieces are picked up by travelers and held in place till they can be secured A deafening roar assails one. It is useless to try and speak, orders are conveyed by gestures and answered in the same way. The air is shot here and there by the glow from the rivet heaters' furnace, hot rivets flash through the air, grimy-faced men wield clanging hammers, riveters puff and roar, the whistle of escaping steam and the crash of falling metal all render an indescribable tumult of sound, whose undertone of progress stays with one while the rest has vanished into the thinner air outside.

The finished cars are next claimed by the paint shop, with its attendant gang of red devils. Here the car is changed from a hulking structure of black steel to a spick and span railroad runabout. The cars stay here as long as they can, a time varying from two to four days, when they are delivered to the owners, who nearly always put them into commission at once.

It is not at all a pleasant life, but it is a fine experience and a great place for a young man. Perhaps fifty different schools are represented there by young fellows, few being old enough to vote. Many are heads of departments and carry their responsibilities on very jaunty shoulders, but they know their work and they do it. Many are there for but a few months, working merely for the experience, and they get plenty of it.

SIGMA NU DANCE.

On the evening of February 19th, the Beta Upsilon Chapter of the Sigma Nu Fraternity entertained with an informal dance at Naylor-Cox hall, and all who attended report a jolly good time.

The hall was tastefully decorated in the colors of the Fraternity, the walls being draped in gold, white and black bunting. Numerous college pennants and Sigma Nu banners could be seen, and behind the orchestra was placed a large pattern of the pin of the Fraternity. Around the hall were a number of couches with a goodly supply of pretty sofa cushions, and an ante-room was conveniently arrange l in the back hall-way.

Breinig's orchestra furnished the music for the twenty-five dances and several extras. The programs were arranged in a novel manner, the name of each piece played being printed beneath the dance. This was a happy thought, for often the names of the most familiar pieces cannot be recalled. Punch was served throughout the evening.

A large number of Rose men and some of the Faculty attended.

Mr. and Mrs. Charles Braman, Mr. and Mrs. Charles Fleming, and Mr. and Mrs. Arthur Goldsmith, acted as chaperons.

This was the second dance given by the Sigma Nus in Terre Haute, and it was one of the most enjoyable dances of the season.

THE FRESHMAN BANQUET.

(By One of Them.)

The annual Freshman banquet, which occurred on Feb. 13, 1903, might have been regarded as a perfectly successful event in the class history, and might have been set down as a complete victory over the Sophomores, had it not been for the untimely interference of unconcerned parties, who, by virtue of their authority, were able to "arrest" the natural course of the proceedings and turn it aside toward an end wholly unjustified by the circumstances.

The Freshman class, therefore, although its plans in regard to the banquet were successful to the letter, restrains from any expression of pride or satisfaction as to the outcome.

Promptly at three o'clock on the afternoon of the day set for the banquet, the two sections of the Freshman class "cut" their respective recitations, quietly left the Institute and scattered in all directions toward their homes, meeting again at the appointed place, where a special interurban electric car was waiting. They boarded the car, and an hour later marched into the Davis Hotel at Brazil, making the corridors ring with the class and R. P. I. yells.

Shortly after the arrival of the next car from Terre Haute the report reached the Freshmen that the Sophs were on hand with decks cleared for action, and just a moment later the cry of "'06" was heard from the hotel lobby. In an incredible short time the Freshmen had left the parlors, where they had been regaling themselves with games and music, and had all assembled in the lobby in response to the summons.

The regular class scrimmage followed, and was bidding fair to be the fight of years when an unexpected interruption on the part of the Brazil police force brought the affair to an abrupt conclusion. When the smoke had rolled away it was found that three Freshmen were missing, but later, upon the further arrest of the Sophomores, they were released, and returned to the hotel.

The banquet was then served and most thoroughly enjoyed by the fifty-one Freshmen whose fifty-one appetites had been sharpened by contact with the rough side of class enthusiasm.

The courses of the feast were, as Mr. Eastwood, the toastmaster, said, "made more delectable by choice intellectual delicacies."

The toasts given were: Old Rose, H. R. Canfield; Athletics, Paul E. Turk; The Ladies, R. B. Hopkins; The Freshmen, R. S. Beatty; The Faculty, E. G. Jones; The Sophomores, Harry Milner; The Future of '06, Carl E. Eppert.

The hearty applause which followed the closing words of each speaker was sufficient evidence of the good things said, and those who were not present have reason to regret that they are not of the Class of '06.

The end came at last, and after giving the R. P. I. yell with such vehemence that the hotel guests were roused from their slumbers, the class boarded their car and returned to Terre Haute.

Much has been said, one way and another, in regard to the action of the citizens and officials of Brazil concerning the disturbance caused by the two classes upon their meeting in the lobby of the hotel.

The writer wishes only to say that little more could be expected of them, living as they do at a rate much slower than the pace of activity and life set by the wide-awake students of the Polytechnic.

The hotel proprietor, in particular, it might seem, has yet to learn that college boys, even though Freshmen, are not to be regarded as fellows who can be foully worsted in a straight-forward business transaction, without looking forward to a time to come.

ROOTERS' CLUB.

The basket ball season just passed has proved that the Rooters' Club is a good thing. We are now ready for the base ball season, and this will give the club more opportunities to show what influence it can have towards the success of our team. The past month has been a sort of rehearsal for the Rooters' Club. We have learned several things in coming together and yelling. In the first place, to have success, the club must have the hearty coöperation of every Rose man. Half a dozen men cannot bring about decided results by themselves. So every man who is interested in the welfare of Rose and wishes to see her team at the top should join at once. It is merely a matter of patriotism. Below is a report from the treasurer, with the names of those men who have paid their dues up to March 3:

A. N. Austin.	B. C. Jacob.
J. S. Brosius.	W. E. Johnson.
H. R. Canfield.	H. S. Kellogg.
I. J. Cox.	H. E. Miller.
C. G. Davies.	H. B. Pettit.
C. R. Demmitt.	M. R. Reed.
L. F. Dorn.	J. F. Regan, Jr.
H. C. Gilbert.	C. E. Robertson.
L. Goodman.	L. A. Touzalin.
W. R. Heick.	H. J. Wilms.
R. B. Hopkins.	D. D. Wright.

Total receipts from above, ...	$13 75
By printing, C. W. Brown, ...	2 00
Cash on hand, ...	$11 75

Respectfully submitted,

J. S. Brosius, Treas.

PURDUE 43, ROSE 13.

HANDICAPPED by the loss of one of our best men in the game with Purdue on February 14th, we again lost to our opponents by the score of 43 to 13. But this score by no means tells the tale, as the great majority of Purdue's points were scored during the first part of the game, before our fellows had gotten half started.

As usual, the playing of Miller, for Purdue, was far superior to that of his team mates. When the ball was put into play by the referee, at the center of the field, Miller's great height enabled him to knock the ball into the hands of one of his forwards who, in turn, passed it quickly to a guard who came running up at full speed. This guard then threw the ball to Miller, who by this time was waiting down near his goal. Miller then, in a matter of fact way, calmly dropped the ball into the basket. This was their plan of campaign at the start, and they kept it up throughout the whole game. It worked all right until the fellows got "next," but from that time on it was not such an easy affair. The only complaint that we have to make is that it took Rose almost the entire first half to make this discovery, and by that time "Long John" had scored 9 field goals, while the rest of the team had scored 6 more between them.

On our side, it looked for the first few minutes as if there would be a shut out, but we did not reckon on the foul goals to be thrown. Cox threw 3 fouls in the first half and 4 more in the second, besides making two goals from the field, which completely overshadowed any field goals thrown by Purdue men. Neither goal was thrown from a clear field, and one was made when there were two Purdue men doing their best to guard him. Thurman also threw a pretty goal, scoring on a difficult chance from one side of the field.

Had our fellows only thrown as many goals in proportion to their chances, as did the Purdue men, there would have been a much closer game and a better score.

At the end of the first half the score stood Purdue 31, R. P. I. 5. In the second half, however, we played our opponents to a standstill, scoring 8 points against 12 for the visitors. In this half Williams was put in center against Miller, and Daily took Williams' place as guard. This change seemed to work better, as Miller only threw 3 goals during the half. About the middle of the half charges of rough playing were made against Hirsch, who had been warned before by the referee. Accordingly, both he and Daily, who played against him, were put out of the game, Rumbley going in for Daily and Collier for Hirsch.

The game was rough from start to finish, but the number of fouls called by no means denoted the number made. In this respect, Rose may consider herself lucky, as she was a much worse offender than the other team. In fact, one had to foul Miller continually in order to prevent him from throwing a goal.

One thing especially noticeable in Purdue's playing was that they never wasted a shot, but always passed the ball to some one who appeared to have a better chance for a basket. As a result, when once they got the ball in their possession they kept it until they had either made a basket, or had at least gotten a good shot for one.

Score:

PURDUE.

Name	First Half Fouls	First Half Foul Goals	First Half Field Goals	Second Half Fouls	Second Half Foul Goals	Second Half Field Goals
Peck, l. f.,	0	0	2	0	0	1
Hirsch, r. f.,	4	0	4	3	0	1
Collier, r. f.,	—	—	—	0	0	0
Miller, c.,	0	1	9	0	2	3
Lucas, l. g.,	4	0	0	4	0	0
Knapp, r. g.,	1	0	0	0	0	0
Total,	9	1	15	7	2	5

ROSE.

Name	First Half Fouls	First Half Foul Goals	First Half Field Goals	Second Half Fouls	Second Half Foul Goals	Second Half Field Goals
I. J. Cox, l. f.,	1	3	0	1	4	2
Thurman, r. f.,	0	0	1	1	0	0
Daily, c.—r. g.,	4	0	0	1	0	0
Barbazette, l. g.,	0	0	0	0	0	0
Williams, r. g.—c.,	1	0	0	1	0	0
Rumbley, r. g.,	—	—	—	0	0	0
Total,	6	3	1	4	4	2

CRAWFORDSVILLE 13, ROSE 32.

On February 22nd we played the Crawfordsville Business College a return game of basket ball, and easily defeated them. The game was fairly clean and very spectacular, affording the spectators a good chance to see how good the Poly boys were at passing the ball and in team work. After the first few minutes of play it was evident to all that we would win, and then the "Rooters" settled down to enjoy a game that they knew would have a favorable ending. It was an unusual opportunity, and was thoroughly enjoyed by every one, as was shown by the various yells and whoops which greeted every good play. I. John Cox, Daily and Fitzpatrick shared the honors of goal throwing, each having about the same number of baskets to his credit. But by far the best play of the game was the goal thrown by Capt. Barbazette from the center of the field. This seemed to paralyze the Crawfordsville team, and from there on we had them at our mercy.

ROSE.		CRAWFORDSVILLE.
I. J, Cox,	Left Forward,	Davis
Fitzpatrick,	Right Forward,	Wheat
Daily	Center,	Fink
Barbazette,	Left Guard,	Esley
Williams,	Right Guard,	Frazier

Goals—Rose 12; Crawfordsville 2.

Foul Goals—Rose 8, Crawfordsville 9.

Fouls—Rose 18, Crawfordsville 16.

BASKET BALL REVIEW.

On summing up the scores of the different basket ball games during the season just passed, we find that Rose has rolled up 157 points against 200 points for her opponents. This result is by no means bad, when we consider the strength of the different colleges against which we have played. Purdue has held the championship of the state for the past few years, and bids fair to win it again this year, while Wabash also has a strong team, and makes up in rough playing for what it lacks in skill and speed.

Another important factor to be considered is, that after the first two or three games, Rose never had her regular team to represent her, some of her men either having been injured or forced to quit through sickness. In a game where team work is absolutely essential to success, the loss of one man from the regular team works havoc with the team, and only constant practice can overcome this, and constant practice we did not have.

Taken all in all, the team made a good showing in going up against much stronger teams, and learning as we should through experience, we ought to give a much better account of ourselves next year.

Wabash	21	Rose	13
Crawfordsville	11	"	12
Purdue	46	"	15
Evansville Y. M. C. A.	11	"	34
Terre Haute "	26	"	19
Purdue	43	"	13
Wabash	29	"	19
Crawfordsville	13	"	32
Total,	200	"	157

BASE BALL.

Those who have any thought of belonging to the base ball team should not put aside the idea of practicing until the season opens, depending upon the last few days before the first game to develop extraordinary ability. Base ball practice does not consist in devoting a few minutes each afternoon on the campus, so come out regularly and make the team of 1903 one of the best that has ever represented the Institute.

SCHEDULE.

Manager Regan has announced the following schedule of games for the base ball team :

April 4—Terre Haute team.
" 11—High School (probably).
" 18—Open, but offered to Butler College.
" 25—Purdue, at Lafayette.
May 2—Wabash, at Crawfordsville.
" 9—Indianapolis Law School, at Indianapolis.
" 14—Kentucky University, at Terre Haute.
" 16—Washington University, of St. Louis, at Terre Haute.
" 23—Indianapolis Law School, at Terre Haute.
" 30—Wabash, at Terre Haute.

Also two games will probable be arranged with the State Normal.

The foregoing is the best schedule Rose has had for several years, and judging from the way those trying for the team are showing up, the team ought, on form, to win at least a majority of these games, especially since so many of them are to be played on our own grounds.

BARR-BARIANS 25, STARVING CUBANS 5.

The first week in March a challenge appeared on the bulletin board which stated in bold and daring words that Barr's Invincible Boarding House Basket Ball Team was ready to meet all other hash-house teams, and serve them defeat in any manner preferred. The Starving Cubans promptly replied, and on March 7 friends of both parties were on hand to witness the initial performance of the star boarders. Wonderful tricks, such as juggling the ball in every conceivable position on the body, jumping, and tumbling, were witnessed. Barr's team seemed to have much the better of it, and the final score stood 25–5 in their favor. The line-up follows:

FIRST HALF.

BARR'S.		STARVING CUBANS.
Bland	C.	Speaker
Wischmeyer	R. F.	Stoddard
Jacob	L. F.	Bowsher
Touzalin	R. G	Post
Krieger	L. G.	Cannon

SECOND HALF.

Heick	C.	Speaker
Dorn	R. E.	Klenk
Bland	L. F.	Kellogg
Touzalin	R. G.	Hahn
Krieger	L. G.	Post

WABASH 29, ROSE 19.

On February 29th, Rose met defeat for the second time at the hands of the Wabash College basket ball five.

The game was full of roughness, due, no doubt, to Wabash being under the mistaken idea that it was foot ball they were playing, while the Polys played the cleanest game they have played this year.

Lack of practice seemed to be the main reason victory did not rest on our banners, for, while we showed up far superior to the Wabash men in passing the ball, still we could not hit the baskets, and that is what counts above everything else in basket ball. From an outsider's point of view our fellows seemed to play too much in bunches, instead of all over the field. Wherever the ball was there were our five, but even though they got the ball there was no one to throw it to who was close enough to the basket to throw it in.

During the intermission, Williams, who played right guard for the Wabash team, said that no forward had thrown a field goal on him for five straight games. Daily, who happened to be playing against him, heard the remark and said that he would take particular pains to see if he could not break the spell during the next half. As a result, it looked for a while as if Rose would win, for in five minutes Daily had thrown four field goals and narrowly missed as many more. Despite our rally, however, and Fitz's foul goals, we were not destined to win, as the score of 29 to 19 only too plainly indicates.

WABASH.

	FIRST HALF.			SECOND HALF.		
Name	Fouls	Foul Goals	Field Goals	Fouls	Foul Goals	Field Goals
Lehman, l. f.	1	4	3	2	1	1
Loop, r. f.,	0	0	1	0	0	0
Marshall, c.,	1	0	1	2	0	2
Funkhouser, l. g.,	4	0	2	0	0	1
Williams, r. g.,	6	0	0	3	0	1
Total,	12	4	7	7	1	5

ROSE.

	FIRST HALF.			SECOND HALF.		
Name	Fouls	Foul Goals	Field Goals	Fouls	Foul Goals	Field Goals
I. J. Cox, l. f.,	1	0	1	0	0	0
Daily, r. f.,	2	0	0	1	0	4
Williams, c.,	1	0	0	0	0	0
Fitzpatrick, l. g.,	1	5	0	1	4	0
Barbazette, r. g.,	3	0	0	1	0	0
Total,	8	5	1	3	4	4

FOOT BALL MANAGER.

Mr. H. L. Watson, '05, has been elected manager of the 1903 foot ball team, and we can safely say that no better man than he could have been selected for the position. Mr. Watson's business ability is too well known to require any comments, and we feel sure that he will give us as good a schedule as can be arranged for next year's team to play.

On being asked for his opinion concerning the base ball team, Mr. Walters expressed himself as follows:

"I have been coaching the candidates for the Rose base ball team for the past month. They have been doing mostly indoor work, and have a good batting cage, which has been very beneficial towards developing some good batters. The team will be picked in a week or so, and I predict a successful season for the Polys. They will be especially strong in pitchers, while the infield is fast and all have good arms. The outfielders are quick on their feet and can cover lots of ground, and the catching department is strong on throwing to bases."

R. P. I. A. A.

At the meeting of the Athletic Association on February 27th, the following men were allowed an R: Eppert, Ingle, Katzenbach, Krieger, McBride, Parr, Ross Speaker, and Stahl.

BATTING CAGE.

The batting cage has been put up in the gym., and almost every day there are squads of men out, awaiting their turn at the plate. Every one seems to be more than pleased with the apparatus, and express the opinion that with the cage and "Lou" Walters both at hand, there will be "something doing" next spring for Rose in base ball.

Ability to hit the ball was our main defect last year, but with a month of practice in the cage, that difficulty ought surely to be overcome.

So whoop 'em up for old Rose, boys, for we are going to have a team to be proud of, and worthy of our heartiest backing and support.

A ball,
A bat,
A base,
A man.
And on the seats an anxious fan.

A curve,
A lurch,
A lunge,
A miss—
Like maddened geese the bleachers hiss.

A crash,
A streak,
A dot,
A speck—
Ten thousand voices gone to wreck.

At first—
Then second—
Then third—
A run!
Ecstatic shrieks—the game is won.

AT OTHER COLLEGES.

The control of athletics at Wabash has been put under the direction of a faculty board.

The Wisconsin girls' basket ball team has been refused permission to play outside teams.

The Indiana University Freshmen defeated the Purdue Freshmen in a dual track meet by a score of 42 to 20.

Cutts, the great Harvard left tackle, has been selected as head coach of the Purdue foot ball team for next season.

A Japanese student at Stanford University is giving instructions in the art of wrestling, as done in Japan.

The Sophomores at Purdue have restricted the wearing of class numerals to those who have earned them through representing the class in an organized meet.

Indiana University beat the Normals on February 28, in the latter's gym., by the score of 30 to 16.

One hundred men have reported for track work at Chicago. There are thirty-five men trying for the ball team.

Over sixty Freshmen have reported for track work at Yale.

Captain Weeks, of Michigan, will coach Missouri next year.

One of Carlisle's foot ball players was an Eskimo.

One hundred and eleven candidates have reported for base ball practice at Michigan.

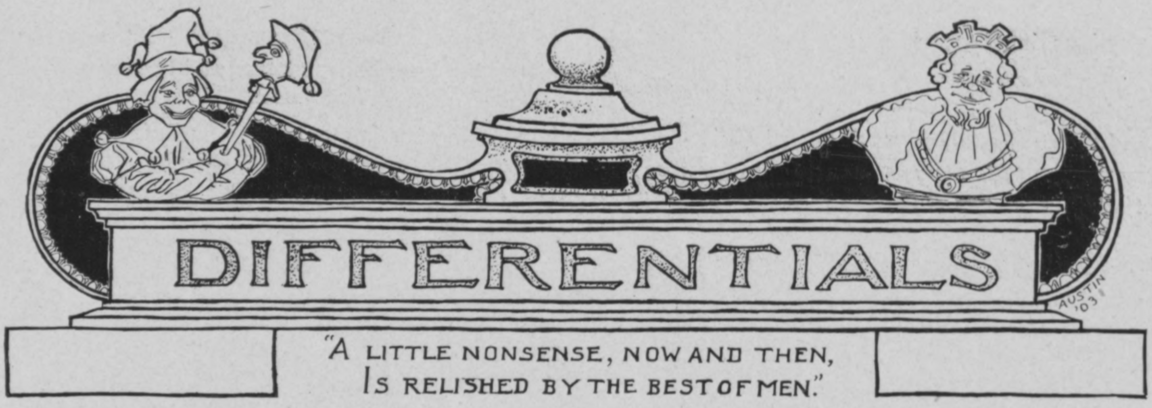
In a dual track meet between Chicago and Illinois, Chicago won by the overwhelming score of of 60 to 16. The best record made was that of the mile in 4:36, the best previou s record being 4:37$\frac{1}{5}$.

The new gymnasium at Princeton, when completed, will be the largest of its kind in the world. Its dimensions will be 100 x 106 feet in the clear, without a column or post interfering.

A bill has been introduced in the lower house of the Missouri Legislature to prohibit the playing of foot ball.

George Woodruff, of Pennsylvania "guards back" fame, will coach the University of Illinois foot ball team next fall.

The question is being agitated now in foot ball circles of increasing the number of yards to be gained in three downs, from five to ten yards. It is thought the result would be to increase open work and decrease mass play.



(TUNE: *Cynthia, Cynthia.*)

I came to Rose Polytechnic
For to be an engineer,
If I don't turn out successful
Then I'll think it very queer.
(Dance.)

Four long years we have to study,
Chemistry, Dutch and Mathematics,
Rankine, Thompson, Tanner and Allen,
Heat and Light and Dynamics.
(Dance.)

In the shops we have to practice,
Woodwork, blacksmith, foundry, too.
Pounding iron and moulding sand
Are among the things we have to do.
(Dance.)

When we graduate from Poly
We will think we're stock preferred
And our simple minds will change then
When we work for six plunks per.
(Dance.)

Cargill (in Chem.):—You see, Doctor, Heaven helps them that help themselves, so we must make an attempt to answer a question to stand in with the Lord.

Every body be out for the track team. If a man runs the hundred in fifteen seconds pat him on the back, for he deserves it for *coming out and trying*. If you can do it better, get out and do it. Above all, "don't knock."

A Junior made the remark that the mere name Mc. Cormick should rally the Freshmen to the track.

O'er coal the soul
No more will fret,
The ills of chills
We'll soon forget;
But woe we'll know
Just as of yore,
The price of ice
Will make us sore.
—[*Ex.*

Basket ball is over, and we are ready for base ball.

Look out for spring fever. It's about time for it to appear.

The following data was found in the laboratory note-book of one of the Sophomores:

Substance	*Reagent*	*Result*	*Inference*	*Precipitate*	*Solution*
Dice	2 bits	crapped	loaded	sweat	strychnine

IT IS BUSY THEN.

How doth the busy little "b"
Become entangled in some trouble?
'Tis when a stutterer we see
Attempting to describe a bubble.
—[*Chicago Tribune.*

Green Freshman:—Is that tall girl up ahead a Normal girl?

Wise Soph:—I don't think; she's an *abnormal* girl.

It is reported that when a Brazil cop went to arrest "Mexico" Wood, he told the policeman that he was a miner from Seeleyville. The cop believed him.

There's a famous class at Poly,
That's known as '06.
It's the class that's going to get there
And teach them all new tricks.

This class once gave a banquet
At good old Brazil town.
The Sophies thought they'd break it,
And trim the Freshies down.

They came in all their glory—
Some thirty odd or more,
And made a dash for Freshmen
Right through the hotel door.

But the Freshmen were too mighty,
And rolled them on the floor,
And the policemen took them to a place
Where they should have been before.

One and twenty Sophomores
Were lodged in Brazil jail,
So the talk about the banquet,
Is to them a sorry tale.

About five hours they languished there,
And enjoyed the mustard oil,
They'd brought along from Terre Haute
The Freshmen's feast to spoil.

It cost them fifty dollars
For this delightful spree,
And the lights of Terre Haute
They were mighty glad to see.

Well, they didn't hurt the banquet,
Which they had tried to fix,
But only livened up the night
For the boys of naughty-six.

'06.

McCormick (in Geometry):—You can never see a complete half of a sphere.

Curry:—Can you ever see a half of anything?

McCormick:—Certainly. You can see a half dollar, can't you?

"Doc": —If you want a barn to be serviceable you must build it in stable condition.

Wicky:—By the way, Mr. Niedheiser, how do you spell your name; *neid* or *nied!*

Niedheiser:—I don't know, Professor.

"Yes, father, when I graduate I am going to following my literary bent and write for money."

"Humph, John; you ought to be successful. That's all you did the four years you spent in college."—[*Punch Bowl.*

NOW WHAT DID HE MEAN?

Dr. Mees:—Do you see anything pretty out there, Smith?

Smith, '06, (who was looking out of the window):—No, sir.

Dr. Mees:—Then look at me.

On the day after the Freshman banquet Prof. Hathaway opened recitation by telling the Sophomores that he would now give them a chance to recite on what they had never seen before.

THE SENIOR'S FINAL EXAM.

The Senior's last exam is o'er:
A smile is on his face,
His reference books, a score or more,
Are scattered 'round the place.

No more exams for him—what joy.
Oh! would that I were he.
With worry over quizzes gone,
How happy I should be.

Throughout the term I don't object
To working problems out,
But when it comes to term exams,
My motto's "cut 'em out."

Who knows—perhaps in future years,
The work his job demands
Will make the Seniors cry aloud,
"Oh! give me back exams."

H. E. Miller, '04, was introduced in a very formal manner to a pretty young lady as Mr. "Dusty." All during the evening the young lady kept calling him Mr. Dusty, and as Miller didn't know exactly what would happen when she found out his real name, he neglected telling her the truth. Finally she heard his real name, and it is reported that water had to be thrown on Miller's face to bring him to life.

Soph:—What is the heighth of politeness?

Junior:—To say "thank you" when a professor hands you a piece of paper for a Calculus quiz.

A man is foolish to drink in order to "get his spirits up," for he is only putting his spirits down.—[*Ex.*

The first American to receive a Cecil Rhodes scholarship is Eugene Lehman, Yale, '02.

A well-known chiropodist advertises as follows: "Have removed corns from almost all the crowned heads of Europe."—[*Ex.*

Join the Rooters' Club, and get ready to yell for our base ball team.

CHARGE OF THE BRAZIL POLICE BRIGADE.

(With apologies, etc.)

Half a block, half a block,
Half a block onward,
Right into the town of Brazil
Charged the brave Sophomores.
On to the Davis House,
Straight to the Freshman feast
Charged the brave Sophomores.

Soon there was rough-house there;
Whoops and yells pierced the air,
And soon Brazilians knew
Something was doing.
Quick! someone call the police,
They'll cause this fight to cease,
They will preserve our peace,
Will our brave peelers.

No time there was to spare,
Cops appeared everywhere,
Pinched every Sophomore there,
Brave were their efforts while
All the world wondered.
Plunged in the strife and smoke,
Right through the bunch they broke;
Freshman and Sophomore
Fell from their fearful stroke
As if outnumbered.

Sophomores to right of them,
Sophomores to left of them,
Sophomores in front of them,
They hauled off to jail.
They would not make reply
When Sophomores questioned why;
Their's but to do or die—
They needed the bail.

Caged in the dingy cell,
They that had fought so well
Now had a chance to smell
Sweet mustard oil.
But soon for peace they sued;
All were in want of food;
Gone was their fighting mood
After their toil.

Half a mile, half a mile,
Half a mile onward,
Back to their welcome bunks
Retreat was made.
Wearied with strife, and sore,
Gone twenty bucks or more;
And all on account of
Brazil's valiant brigade.

When can their glory fade?
Oh! the wild charge they made.
Noble police.
Brazil should on all bestow
Medals that e'er will show
How they repulsed the foe,
And preserved peace.

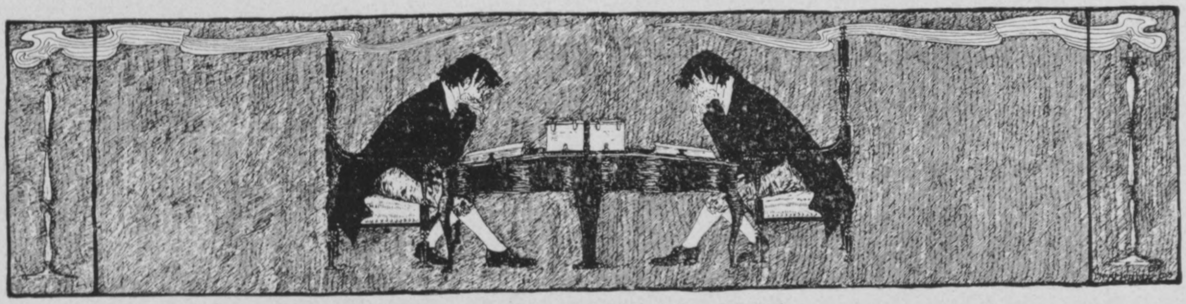
On account of the small number of new yells handed in, the contest for the three pennants has been extended for two more weeks. If by that time no more yells are received one pennant will be awarded to the best on hand. On February 13th the Rooters' Club distributed leaflets on which were printed seven yells and two songs. The songs were composed by A. W. Lee, '06. These yells and songs will be used during our base ball season, when the Rooters' Club expects to do great work, so every one should learn them.

"Evolution," quoth the monkey,
"Makes all mankind our kin;
There's no chance at all about it,
Tails we lose, heads we win."
—[*Ex.*

Invitations have been received announcing the marriage of Mr. Merton L. Dodge, formerly of '03, to Miss Mattie K. Van Vlack. The wedding is to take place March 17th, at 1030 Chestnut street, Erie, Pa.

TALE OF A STUDENT.

Cram.
Exam.
Flunk.
Trunk.
—[*Ex.*



REVIEWS

TAYLOR-WHITE PROCESS OF TREATING STEEL.

IN an abstract of the report of the Committee of the Franklin Institute on the Invention of Wamsel White and Fred W. Taylor, printed in the Engineering Record is given some of the qualities of steel treated by the Taylor-White Process. Quoting in part :—

In the patent specifications Messrs. Taylor and White say in part : "Our invention relates to the manufacture of tools for cutting metals or similar uses where the tool is highly heated in performing its work, the object of our invention being to provide a tool capable of working at higher temperature, and consequently doing more work in a given time than the tools as heretofore made." The above statements make it very clear that the tool is adapted to roughing work only, and unless sufficient speed can be obtained, no gain in output can be had. We wish to make this point perfectly clear.

Again, in the patent papers, we find a general statement of the invention: "Our invention is based on our discovery that, while it is true tools made of air-hardening steels all deteriorate at temperatures in excess of a bright cherry-red (though it must be understood, not all at the same temperature), it is also true that when air-hardening steels are made with certain constituents in ascertained proportions this deterioration only prevails during a limited range of temperatures above the bright cherry-red ; that is to say, from about 1,550 degrees Fahr. to about 1,700 degrees (corresponding to a light salmon color), and on our further discovery that above this range of temperature, which we will call the "breaking-down point," and from 1,725 degrees up to a temperature at which the steel softens or crumbles when touched with a rod (approximately 1,900 or 2,000 degrees) the efficiency of tools of such special steels; that is to say, their cutting speeds, and also their uniformity in efficiency, is greatly increased and largely so in proportion to the degrees of heat to which they are raised. This is so much the case that their cutting speed may be stated to be from 1½ to 2½ times that of the tool heated as heretofore, to a temperature below the breaking-down point.

When treated with the higher heats and to obtain the best results, the steel of the tools shows under the microscope a distinctly larger-grained structure, in many cases intercepted with austenite or microconstituent of steel discovered by Osmond, the chemical composition of which is unknown, and which, according to the best authorities, has never been met with in the industrial treatment of steel. The tool is cooled rapidly from the high heat to a point below the breaking-down temperature in a lead bath, then slowly in the air or lime, etc., as the case may be. It is very essential that at no time the temperature should rise, as in such a case the tool would be seriously impaired. After the tool has cooled off, its efficiency is found to be further increased by subjecting it to what is termed the low heat for about ten minutes, this temperature ranging from 700 to 1,200 degrees.

The tool, after being forged, is placed in a coke furnace, where it is heated gradually to a high heat, the latter being designated as the point at which the steel crumbles when tapped with a rod. As the tool is incandescent at this point, it is necessary that the operator wear colored glasses while testing for heat. After heating, the tool is rapidly drawn from the furnace and plunged into a lead bath, in a cast iron retort heated from below by means of a coke fire, the intensity of which may be increased at will by means of a blast of air. If the temperature rises too high, a closed pipe, which has cold water circulating in it, can be lowered into the bath.

Three different test-pieces were experimented on, two of steel and one of cast iron. All the tools tested were brands on the market at the time the Taylor-White patents were granted. An examination of the accompanying tables show for the 86 C. forging or test-piece that the relative efficiency of the treated tool and best untreated tool is 11 to 3 or more than 3.5 to 1, for the soft forging (10 carbon) 156 to 70 or 2 2 to 1, and for cast iron 70 to 55 or slightly less than 1.3 to 1. These figures show that for steel the efficiency is much greater for hard forgings than for soft, but even in the latter case exceeds two to one, while as we might expect the saving on cast iron is much less, being about 1¼ to 1. On hard castings, however, the gain is much more, often reaching 2 to 1, and on this account it is well adapted to certain work. In proof of the latter statement we might add that at the Link-Belt Engineering Company's works, Nicetown, hard-sprocket wheels can be bored at more than double the speed with Taylor-White tools.

Reference to the table shows a cutting speed of 156 feet per minute, with $\frac{3}{16}$-inch depth of cut and $\frac{1}{16}$-inch feed. This tool was removing metal at the rate of 353 pounds per hour and was red-hot $\frac{5}{16}$ inch from the point. The color was distinctly visible in the daylight, no stronger proof being needed of the high heat at which these tools maintain their cutting edge. At the end of twenty minutes the edge of the tool was carefully examined with a magnifying glass and found to be perfect. In fact, the original grinding marks could still be detected.

A STATIC CONVERTER.

THE February number of the *American Electrician* contains a description of a most remarkable apparatus for the conversion of alternating into direct current. The apparatus has been developed by Mr. Peter Cooper Hewitt, as a result of his investigations of the properties of mercury vapor tubes. It consists of a vacuum bulb, containing some mercury, at the top of which are sealed the lead-in wires from the leads for the different phases of the circuit. In the bottom of the bulb is another electrode which is connected to one side of the working circuit, the other side of which is connected to the neutral point of the alternating-current circuit. The operation of this simple converter depends upon the peculiar properties of electrodes sealed in a receptacle containing vapor at a certain degree of attenuation; under this condition, the electrodes act as electric valves, permitting passage to one-half of the alternating-current wave and suppressing the other half.

The current in the working circuit is of the nature of a direct pulsating current, so that the greater the number of phases delivered to the converter, the more nearly will the current approach a continuous current.

The beauty of this converter is that it is very small. For a converter having a rated capacity of eight kilowatts the globe is about seven inches in diameter and about nine inches in extreme length, weighing only about three pounds.

H. B. P.

MEASUREMENT OF CONTACTS.

IN the *American Machinist* for Feb. 19, 1903, there appears an article by H. D. Williams on point and line contacts of spheres, rolls and gears. Heretofore the exact ratio of the carrying capacity of large rolls, or balls, to that of smaller ones, has been unknown, or at least, only so far as a few experiments have demonstrated, and the proportioning of such parts has been left to the experience or imagination of the designer. Mr. Williams' is probably the first attempt to establish the quantities and ratios of contacts, by which, experiments upon different sizes of balls and rolls could be standardized, and constants determined for use in designing.

The article is too long to reprint in its entirety, but Mr. Williams establishes, from the fact that "the amount of contact between plane and curved and two curved profiles is measured by the reciprocal of the relative curvature," the unit of profile contact, and gives the constants for several special cases which he has examined.

ENGINEERING INDEX.

PERHAPS one of the most useful things which the engineer finds in the scientific publications is the index to current articles, which some of them contain. As it is impossible for him to go through all the magazines, even those printed in the English language, the only way for him to find discussions of subjects in which he is interested, is to refer to one of these indexes.

Since the Association of Engineering Societies abandoned their index in 1895, this work has been continued and perfected by the *Engineering Magazine*, in which there appears every issue a list of all the articles of any value to the several branches of engineering. This list includes the title, author and description of the article, and the name and date of publication in which it appears. By this means the contents of about two hundred journals, printed in English, French, German, Dutch, Italian and Spanish, are brought before the reader.

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March 19. Mrs. Fiske, In Mary of Magdala.
" 20. Return of, For Her Sake.
" 21. Maloney's Wedding Day.
" 23. Al. H. Wilson, In A Prince of Tatters.
" 24. Captain Jinks.
" 25. Alaska.
" 26. The Burglar and The Waif.
" 28. Hill's Bill.
" 30th and Week. Howard Dorset Co.
April 6. 8 Bells.
" 8. Wm. Owen.
" 10 and 11. An Orphan's Prayer.
" 13. Over Niagara Falls.
" 14. Henrietta Crosman.

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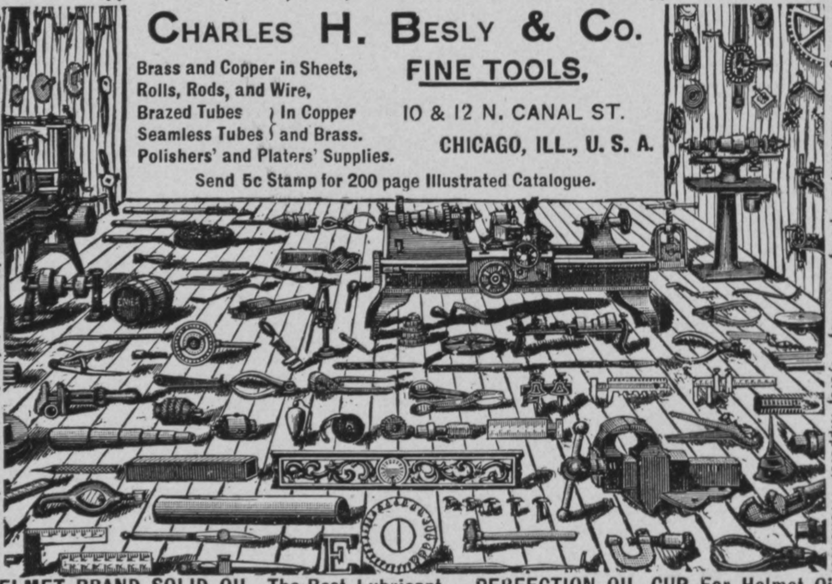

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